Calculus Warm Up # 9-2

Remember:

$\frac{d}{dx} \tan x = \sec^2 x$

Evaluate:

1. $\int \sec^2 3x \, dx$

2. $\int \frac{\sec^2 \sqrt{x}}{\sqrt{x}} \, dx$

3. Find the volume of the solid created by revolving f(x) about the x-axis on [0, π].

$f(x) = \sqrt{\sin x}$

HW Questions: p. 456

1. $\int (2 \sin x + 3 \cos x) \, dx$

2. $\int (t^2 - \sin t) \, dt$

7. $\int \sin 2x \, dx$

8. $\int \cos 6x \, dx$

9. $\frac{1}{2}\int 2x \cos x^2 \, dx$ $u = x^2$ $du = 2x\,dx$ **10.** $\int x \sin x^2 \, dx$

27. $\int \frac{\cos t}{1 + \sin t} \, dt$

29. $\int \frac{1 - \cos \theta}{\theta - \sin \theta} \, d\theta$

31. $\int e^x \cos e^x \, dx$

33. $\int e^{-x} \tan(e^{-x})\, dx$

35. $\frac{1}{2}\int 2(\sin 2x + \cos 2x)^2\, dx$ $\quad u = 2x \quad du = 2\,dx$

$$\frac{1}{2}\int (\sin^2 u + 2\sin u \cos u + \cos^2 u)\, du$$

$$\frac{1}{2}\int (1 + \sin 2u)\, du$$

$$\frac{1}{2}\left[\int 1\, du + \frac{1}{2}\int 2\sin 2u\, du\right]$$

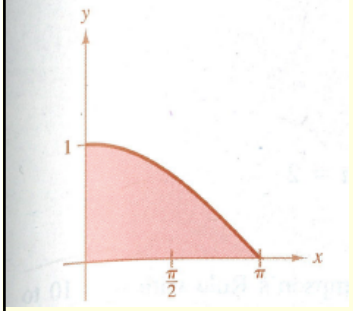
$$\frac{1}{2}\left[u + \frac{1}{2}(-\cos 2u)\right] + C$$

$$x - \frac{1}{4}\cos 4x + C$$

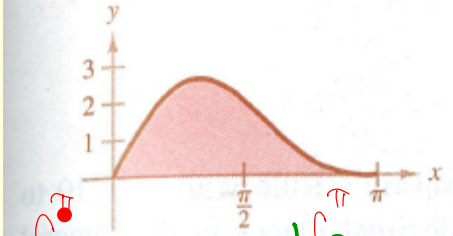
37. $\int_0^{\pi/2} \cos\frac{2x}{3}\, dx$

Find the area:

45. $y = \cos\frac{x}{2}$



47. $y = 2\sin x + \sin 2x$



$$A = 2\int_0^{\pi} \sin x\,dx + \frac{1}{2}\int_0^{\pi} 2\sin 2x\,dx$$

$$= 2\left[-\cos x\right]_0^{\pi} + \frac{1}{2}\left[-\cos 2x\right]_0^{\pi}$$

$$= -2\left[\cos x\right]_0^{\pi} - \frac{1}{2}\left[\cos 2x\right]_0^{\pi}$$

THEOREM 8.5 BASIC TRIGONOMETRIC INTEGRATION FORMULAS

If you memorize the differentiation formulas, it is easier to recognize the derivatives in the integrand!

Differentiation Formula	*Integration Formula*
$\frac{d}{dx}[\sin u] = \cos u\frac{du}{dx}$	$\int \cos u\,du = \sin u + C$
$\frac{d}{dx}[\cos u] = -\sin u\frac{du}{dx}$	$\int \sin u\,du = -\cos u + C$
$\frac{d}{dx}[\tan u] = \sec^2 u\frac{du}{dx}$	$\int \sec^2 u\,du = \tan u + C$
$\frac{d}{dx}[\sec u] = \sec u\tan u\frac{du}{dx}$	$\int \sec u\tan u\,du = \sec u + C$
$\frac{d}{dx}[\cot u] = -\csc^2 u\frac{du}{dx}$	$\int \csc^2 u\,du = -\cot u + C$
$\frac{d}{dx}[\csc u] = -\csc u\cot u\frac{du}{dx}$	$\int \csc u\cot u\,du = -\csc u + C$

From yesterday:

$$\int \sin u\,du = -\cos u + C \qquad \int \cos u\,du = \sin u + C$$

$$\int \tan u\,du = -\ln|\cos u| + C \qquad \int \cot u\,du = \ln|\sin u| + C$$

What about sec x and csc x?

$\int \sec x\,dx$ $\frac{\sec x+\tan x}{\sec x+\tan x}$ rename

$$\int \frac{\sec^2 x + \sec x \tan x}{\sec x + \tan x}\,dx$$

$u = \sec x + \tan x$

$du = \sec x \tan x + \sec^2 x$

$$\int \frac{1}{u}\,du$$

$$\int \sec x\,dx = \ln|\sec x + \tan x| + C$$

$$\int \csc x\,dx =$$

THEOREM 8.6
INTEGRALS OF THE SIX BASIC TRIGONOMETRIC FUNCTIONS

$$\int \sin u\,du = -\cos u + C \qquad \int \cos u\,du = \sin u + C$$

$$\int \tan u\,du = -\ln|\cos u| + C \qquad \int \cot u\,du = \ln|\sin u| + C$$

$$\int \sec u\,du = \ln|\sec u + \tan u| + C \qquad \int \csc u\,du = -\ln|\csc u + \cot u| + C$$

Using Trig Identities:

$$\int \tan^2 x \, dx = \int (\sec^2 x - 1)\, dx$$

$$\tan x - x + C$$

$$\int (\csc x + \sin x)(\csc x)\, dx$$

$$\int \left(\csc^2 x + \sin x \cdot \frac{1}{\sin x}\right) dx$$

$$-\cot x + x + C$$

More Examples: Recognize derivatives!

$$\int 4 \cos^2 4x \sin 4x \, dx$$

$$\int \frac{\sec^2 x}{\sqrt{\tan x}}\, dx$$

HW: p. 456, # 3 - 6,

#11-25 odd (skip 21),

#39-43 odd, 52-54

Integration Rules: p. 473

week 8 HW: pgs. 399, 404, 415, salmon ws